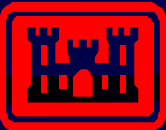


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# **Economic Analysis Water Resources Planning ( EA-WRP )**

## **Deep-Draft Waterborne Navigation Analysis An Overview**

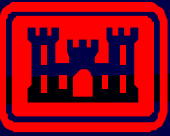


# *Deep-Draft Waterborne Navigation - An Overview*

## • *Outline or Topic Agenda*

- *I. Introduction; Purpose & Objectives*
  - *General References for Guidance & Procedures*
- *II. Basis for Benefit Measurement Benefit Categories*
- *III. Planning Settings*
- *IV. National Economic Development (NED)  
Evaluation  
Process*
- *V. Other\Notable Economic Considerations*

*(continued)*

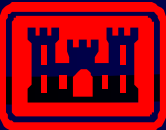


# *Deep-Draft Waterborne Navigation - An Overview*

- **Outline or Topic Agenda** *(continued)*

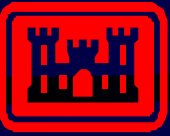
- VI. National Economic Development  
(NED Cost(s)
- VII. Navigation Data & Related Sources
- VIII. Abbreviated Exercise(s)
- IX. Supplemental Information\Slides
- X. End;

*Open Time for  
Questions/Discussion*



# *Deep-Draft Waterborne Navigation - An Overview*

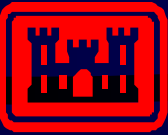
- *Institute for Water Resources  
(IWR)*
  - *Navigation & Water Resources  
Applications Division (CEIWR-NA)*
    - *Ian A. Mathis (Economist); (703) 428-  
7257*  
  
*7701 Telegraph Road  
Casey Building (Building #2594)  
Alexandria, Virginia 22315-3868*



# *Deep-Draft Waterborne Navigation - An Overview*

- ***Purpose***

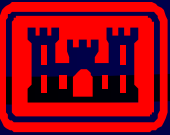
- To provide an overview of the requirements and procedures for conducting deep-draft navigation economic analyses in accordance with standards and guidance as applied by the U.S. Army Corps of Engineers (USACE).*



# *Deep-Draft Waterborne Navigation - An Overview*

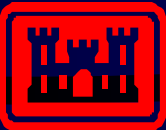
- ***Objective(s)***

- *Identify the General Concepts and Procedural Steps for Economic Analysis Applied to the Study of Deep-Draft Waterway Improvements Under **National Economic Development (NED)** Criteria.*
- *Identify primary sources of guidance and data , and exposure to some of the general terminology applied for studies.*



# *Deep-Draft Waterborne Navigation - An Overview*

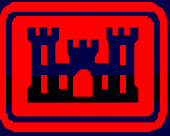
- *Primary References for Planning and Analytical Guidance*
  - *Water Resource(s) Council's (WRC) Economic and Environmental Principals and Guidelines for Water and Related Land Resources Implementation Studies*  
[alternatively identified as the Principals and Guidelines or "P&G"]
  - *Engineering Regulation (ER) 1105-2-100*  
[ alternatively identified as the Planning Guidance Notebook or "PGN" ]  
*(continued)*



# *Deep-Draft Waterborne Navigation - An Overview*

- *Primary References for Planning and Analytical Guidance* (continued)
  - *Planning Manual* [IWR Report No. 96-R-21; November 1996]
  - *National Economic Development (NED) Procedures Manual - Deep-Draft Navigation* [ IWR Report No. 91-R-13; November 1991 ]
  - *Engineering Manual (EM) 1110-2-1613, Hydraulic Design Guidance for Deep-Draft Navigation Projects* [April 1983 or as currently revised]





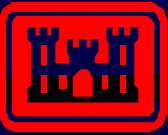
# *Deep-Draft Waterborne Navigation - An Overview*

- ***Conceptual Basis for Benefits***

- *The Reduction In The Value of  
(Economic) Resources Required to  
Transport Cargo or Commodities*

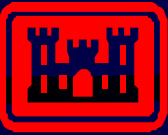
*and*

- *The Increase In The Value of Output  
for Associated Goods and Services*



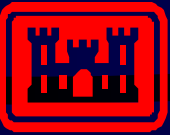
# *Deep-Draft Waterborne Navigation - An Overview*

- ***Principal Direct Economic Benefits***
  - *Elimination or Reductions in Transportation Cost(s)*
  - *Benefits for Shift-of-Origin or Shift-of-Destination*
  - *Induced Movements*



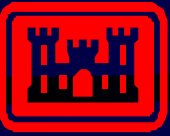
## *Deep-Draft Waterborne Navigation - An Overview*

- ***Elimination or Reductions In Transportation Costs(s)***
  - *Employment of Larger Vessels*
  - *More Efficient Use of Vessels*
  - *Lower Tug Assistance or Handlings Cost(s)*
  - *Reductions In Transit Time (Waterborne or Landside, etc.)*
  - *Use of Alternative Mode (Land vs. Water, etc.)*



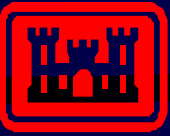
## *Deep-Draft Waterborne Navigation - An Overview*

- ***Shift-of-Origin/Destination & Induced Movements Benefits***
  - *Shift-of-Origin/Destination - Realignment to/from Other Ports or Transport Facilities (typically to reduce costs)*
  - *Induced - Change in Mode or Scale of Cargo Throughput Activity and Related Cost(s) Via New or Unique Movements That Would Not Have Occurred or Existed Without Waterway Improvements*



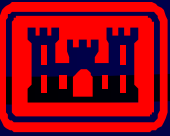
# *Deep-Draft Waterborne Navigation - An Overview*

- *Planning Settings*
  - *Historical Conditions*
  - *Existing Conditions*
  - *Future Conditions*
    - “*With-Project*”
    - “*Without-Project*”



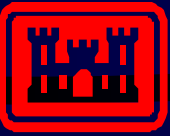
# *Deep-Draft Waterborne Navigation - An Overview*

- ***“Without-Project” Condition(s)***
  - *In the General Context of Planning: The Most Likely Condition(s) Expected to Prevail Over the Planning Horizon in the Absence of a Specified Course of Action or Plan.*
  - *Specific to USACE Navigation Studies: The Most Likely Conditions Expected to Prevail Without the Implementation of Proposed Waterway Improvements.*



# *Deep-Draft Waterborne Navigation - An Overview*

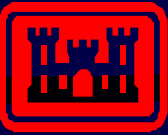
- ***“With-Project” Condition(s)***
  - *In the General Context of Planning*: The Most Likely Condition(s) Expected to Prevail Over the Planning Horizon if a Given Course of Action or Plan is Implemented.
  - *Specific to USACE Navigation Studies*: The Most Likely Conditions Expected to Prevail and *Uniquely Attributable* to Implementation Proposed Improvements.



## *Deep-Draft Waterborne Navigation - An Overview*

- *Basic **Economic** Criteria for Plan Formulation\Selection\Optimization*
  - *Plan, Alternative or Increment Where Net Economic Benefits (Above Project Costs) are Maximized.....*
    - ...Subject to Reasonable Assessment of Marginal or Incremental Economic Costs vs. Benefit(s) or Economic Return(s).*

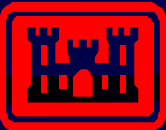




# *Deep-Draft Waterborne Navigation - An Overview*

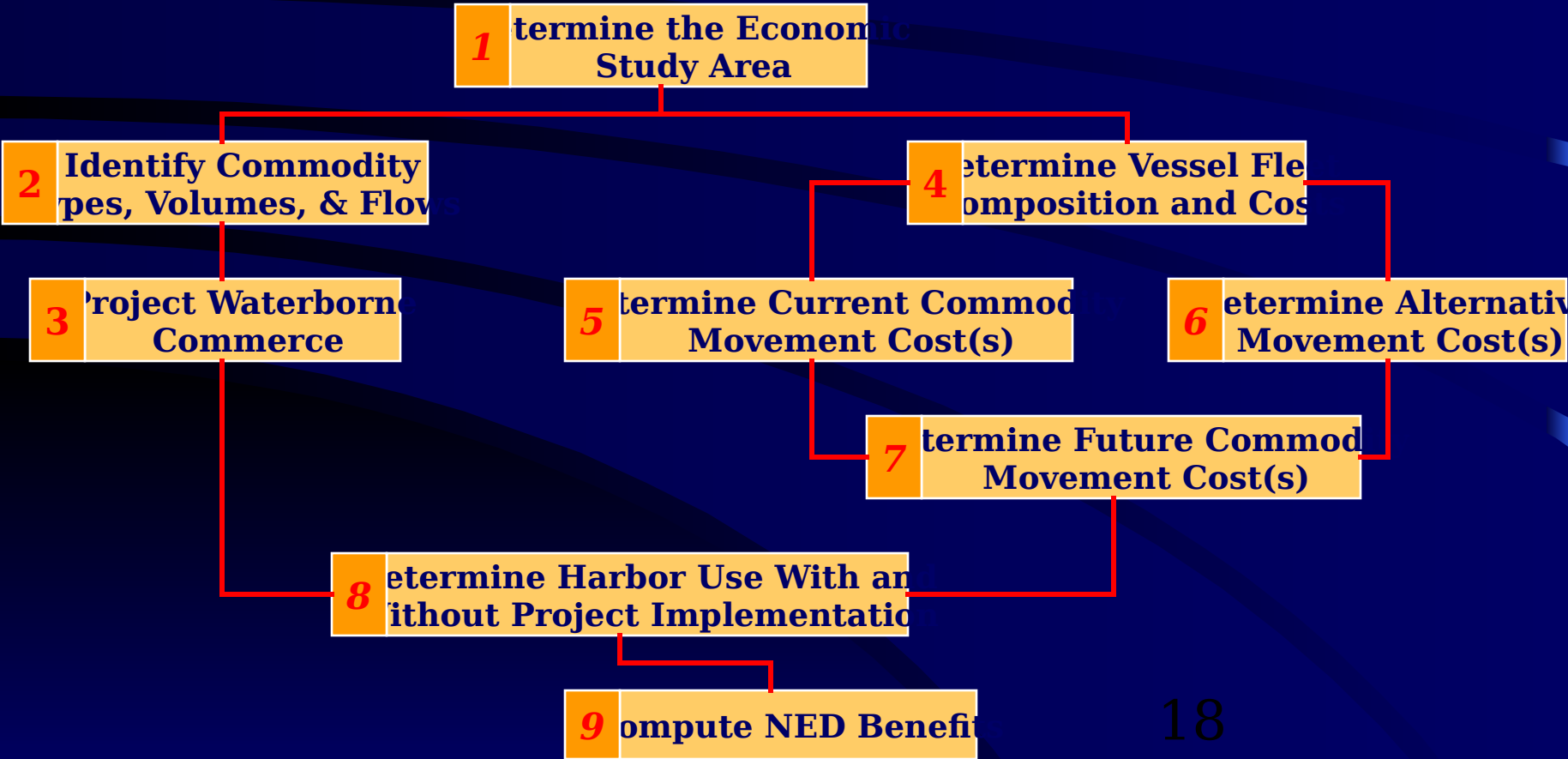
- *Basic Steps of the Evaluation Process*

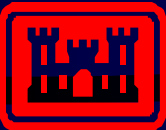
- As Presented by the *Principals and Guidelines (P&G)*
- As Presented by the *NED Procedures Deep-Draft Manual (IWR Report 91-R-13; November 1991)*
- *Process is Not Characteristically Comprised of Rigid or "Discreet" Requirements in Terms of a Detailed Model, Structure, or Order of Process for Analysis.....*



# Deep-Draft Waterborne Navigation - An Overview

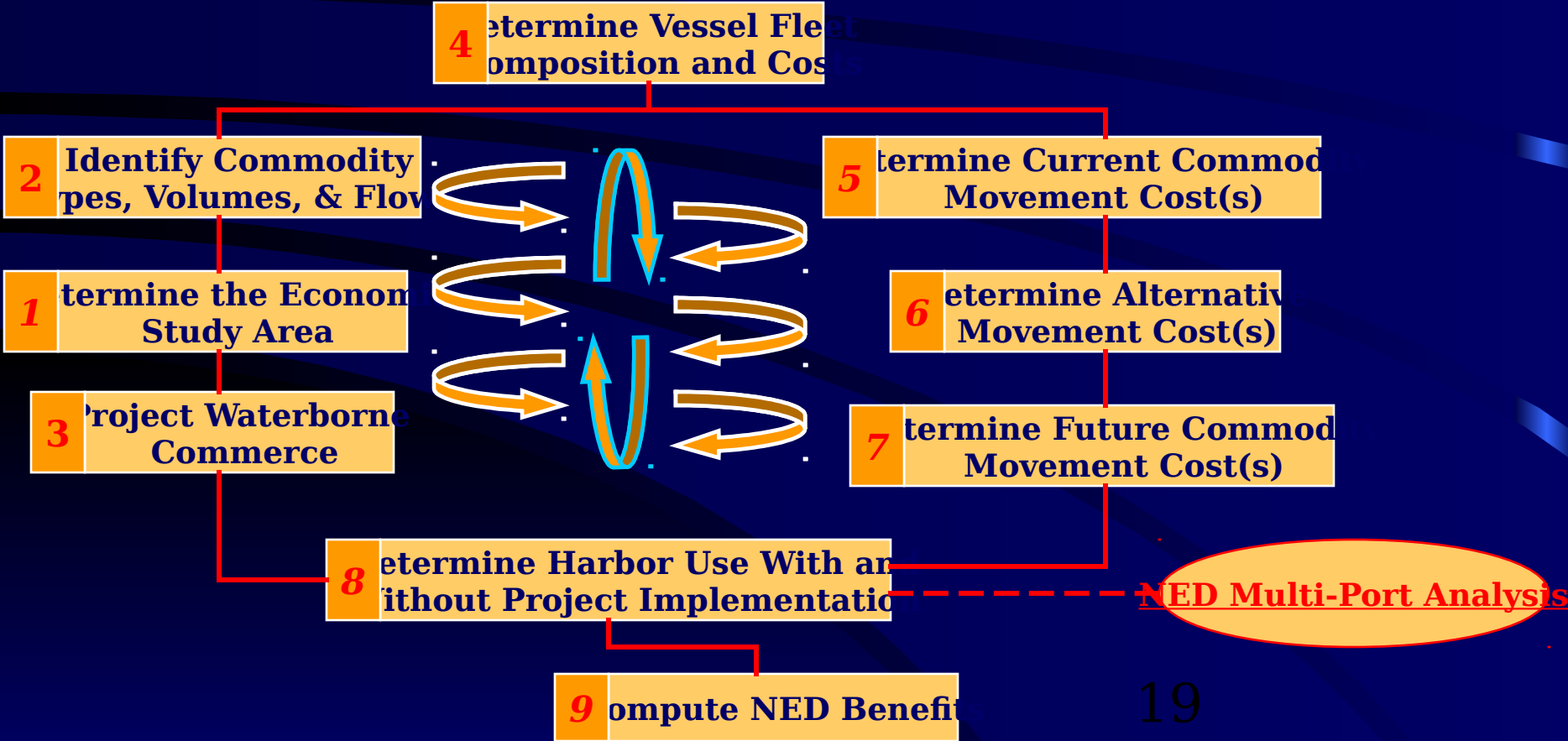
## C's P&G 9-Step NED Evaluation Process Schematic

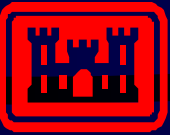




# Deep-Draft Waterborne Navigation - An Overview

## NED Procedures Deep-Draft Navigation Manual 9 Step Evaluation Process

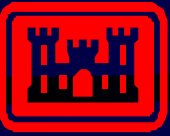




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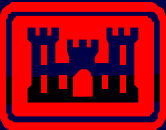
# *Deep-Draft Waterborne Navigation - An Overview*

- *Detail of the Basic 9-Step  
Process*



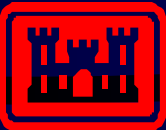
## *Deep-Draft Waterborne Navigation - An Overview*

- *Determine Economic Study Area*
  - *Origin to Destination*
  - *Will Vary by Commodity*
  - *Competing ports and modes are factors*



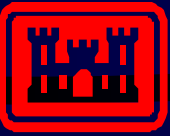
# *Deep-Draft Waterborne Navigation - An Overview*

- *Identify Commodity Types, Volumes & Flows*
  - *Which commodities are likely to be impacted by the proposed improvement.*
  - *What are the expected tonnages*
  - *What are the expected routes*



## *Deep-Draft Waterborne Navigation - An Overview*

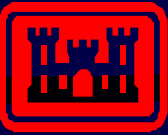
- *Project Waterborne Commerce*
  - *Projections supplemented with interviews and historical data.*
  - *By commodity*
  - *20 years is usually sufficient*
  - *Sensitivity Analysis*



# *Deep-Draft Waterborne Navigation - An Overview*

- *Vessel Fleet Service  
Composition Cost(s)*
  - *Vessel Characteristics*
    - *Route, Commodity, Distance*
    - *Draft, DWT, Immersion Factors*
  - *Current and Future Fleets*
  - *Vessel Operating Costs*



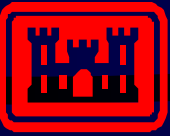


## *Deep-Draft Waterborne Navigation - An Overview*

- ***Determine Current Costs of  
Commodity or Cargo Transport***

*(With Regard to Origin/Destination as  
Appropriate)*

- *Ocean Transit Costs*
- *Handling/Transfer Costs*
- *Hinterland/Tributary (Landside or  
Inland Waterway) Transit Cost(s)*

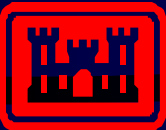


# *Deep-Draft Waterborne Navigation - An Overview*

- ***Determine Alternative Movements  
Cost(s)***

*(Next Best Alternative(s); Applicable?)*

- *Lightering, Topping-Off, or Offshore Facilities*
- *Transshipment Facilities*
- *Pipelines*
- *Traffic/Port Facility Management*
- *Other Transport Modes*
- *Competitive Harbors*
- *Other?*

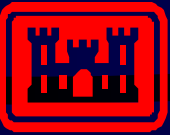


## *Deep-Draft Waterborne Navigation - An Overview*

- ***Determine Future Commodity Movement Cost(s)***

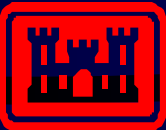
*Relative to **Foreseeable** & **Probable**  
Changes In:*

- Fleet Service and/or Composition*
- Port Logistics (Delays, Throughput Process, etc.)*
- Port Throughput Capacity (Undertaken Relative to Time & Resources)*



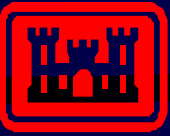
## *Deep-Draft Waterborne Navigation - An Overview*

- *Determine Harbor or Waterway System Use Under “**With**” & \vs. “**Without-Project**” Conditions*
  - *Compare costs for alternatives to determine use*
  - *Integrate **Multi-Port Analysis** (as Appropriate)*
  - *Identify and Quantify Uncertainties*



# *Deep-Draft Waterborne Navigation - An Overview*

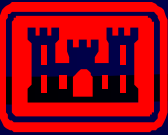
- ***Calculate or Quantify **National Economic Development (NED)** Benefits***  
*(Cost Reduction Benefits - Examples)*
  - *Same Cargo Flow, Origin/Destination, Harbor*
  - *Same Cargo Flow, Origin/Destination, New or Alternative Harbor*
  - *Same Cargo Flow, Origin/Destination, Alternative Mode.*
  - *Induced Movement*



# *Deep-Draft Waterborne Navigation - An Overview*

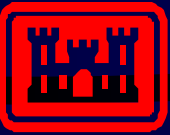
- ***Notable Economic Evaluation Considerations***
  - *Fleet changes*
  - *Service changes*
  - *Vessel Load Parameter(s) and Logistics*
  - *Commodity changes*
  - *Sensitivity*
  - *R&U*

*(continued)*



## *Deep-Draft Waterborne Navigation - An Overview*

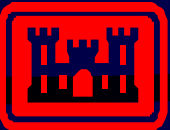
- *General Guideline for Level of Effort  
for Process or Analysis*
  - *Undertaken Until It Is or Can be  
Determined Additional Significant Effort  
or Analysis Would Not Yield or Result In a  
Significant Variance in Finding  
Concerning Disposition for Both  
Justification and Plan Formulation.....*  
  
*.....Subject to Time and Budgetary  
Constraints for Studies.....*



# *Deep-Draft Waterborne Navigation - An Overview*

- ***Historical Findings of the Army Audit Agency (AAA)***
  - *Economic benefits often or typically overstated (relative to intent of applied guidance)*
  - *General lack or absence of multi-port analysis*
  - *Commodity\cargo projections not current or updated as might otherwise be appropriate*
  - *Frequent inconsistencies in fleet service projections*
  - *Vessel\Carrier size often overstated or overestimated*
  - *Inconsistency(ies) in comparison of with vs. without-project conditions.*

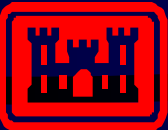




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# *Deep-Draft Waterborne Navigation - An Overview*

- Notes or Questions:

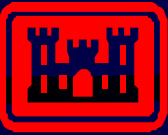


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# *Deep-Draft Waterborne Navigation - An Overview*

- *Short Break*

- 10 Minutes



# *Deep-Draft Waterborne Navigation - An Overview*

- *Abbreviated Exercise(s)*
  - *Plan  
Formulation\Selection\Optimization*
  - *Sample Calculation of Vessel  
Loading(s) & Immersion, &  
Derivation of Associated cargo  
Unit Costs*
    - *Bulk Carrier*
    - *Containerized Cargo Carrier*



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# *Deep-Draft Waterborne Navigation - An Overview*

- *Open Period for  
Questions/Discussion*

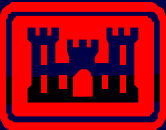
- *END*



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# *Deep-Draft Waterborne Navigation - An Overview*

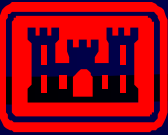
- Supplemental Slides\Information



# *Deep-Draft Waterborne Navigation - An Overview*

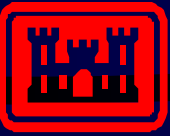
- ***Navigation Data & Related Sources - General***

- *Required Sources are Multiple or Numerous.....Currently There Does Not Exist One Singular Source Applicable to the Needs of USACE Deep-Draft Navigation Studies*
- *Not Always Readily or Consistently Available in Desired Level of Detail or in Time Series for All Studies*
- *Sources Often Require Notable Lead and Labor Time to Acquire & Compile, Reconcile, and Refine*
- *Applicable Sources Include Governmental & Private-Sector Entities*
- *Some Critical Sources are Commercially-Based and Require Purchase for Acquisition*
- *Nature of Data Requires Update or Currency for Reasonable Analysis*  
*(reference supplemental slides for a listing of typical sources)*



## *Deep-Draft Waterborne Navigation - An Overview*

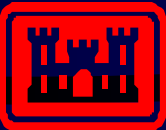
- Supplemental Slides\Information for Reference\Individual Review
  - General Schematics for Considerations of Risk & Uncertainty (R&U) Analysis
  - General Schematics for Waterway Terminology\Nomenclature
  - Information Concerning Research Efforts for Improvements to Waterborne Navigation Analysis & Planning



## *Deep-Draft Waterborne Navigation - An Overview*

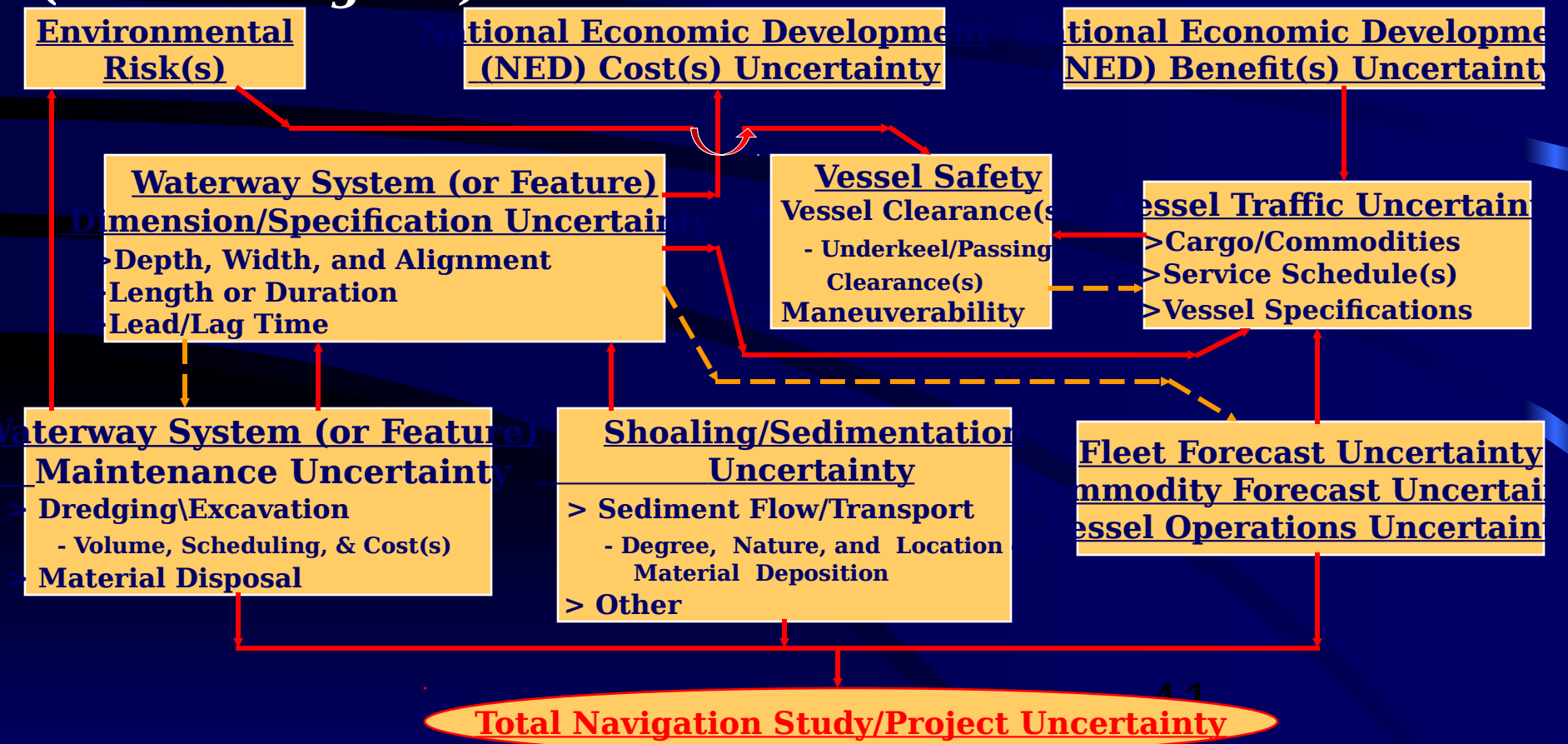
- General Schematics for Waterborne Navigation Risk & Uncertainty
  - “Flow” Diagram
  - “Hierarchal-Order” Diagram

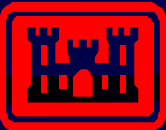




# Deep-Draft Waterborne Navigation - An Overview

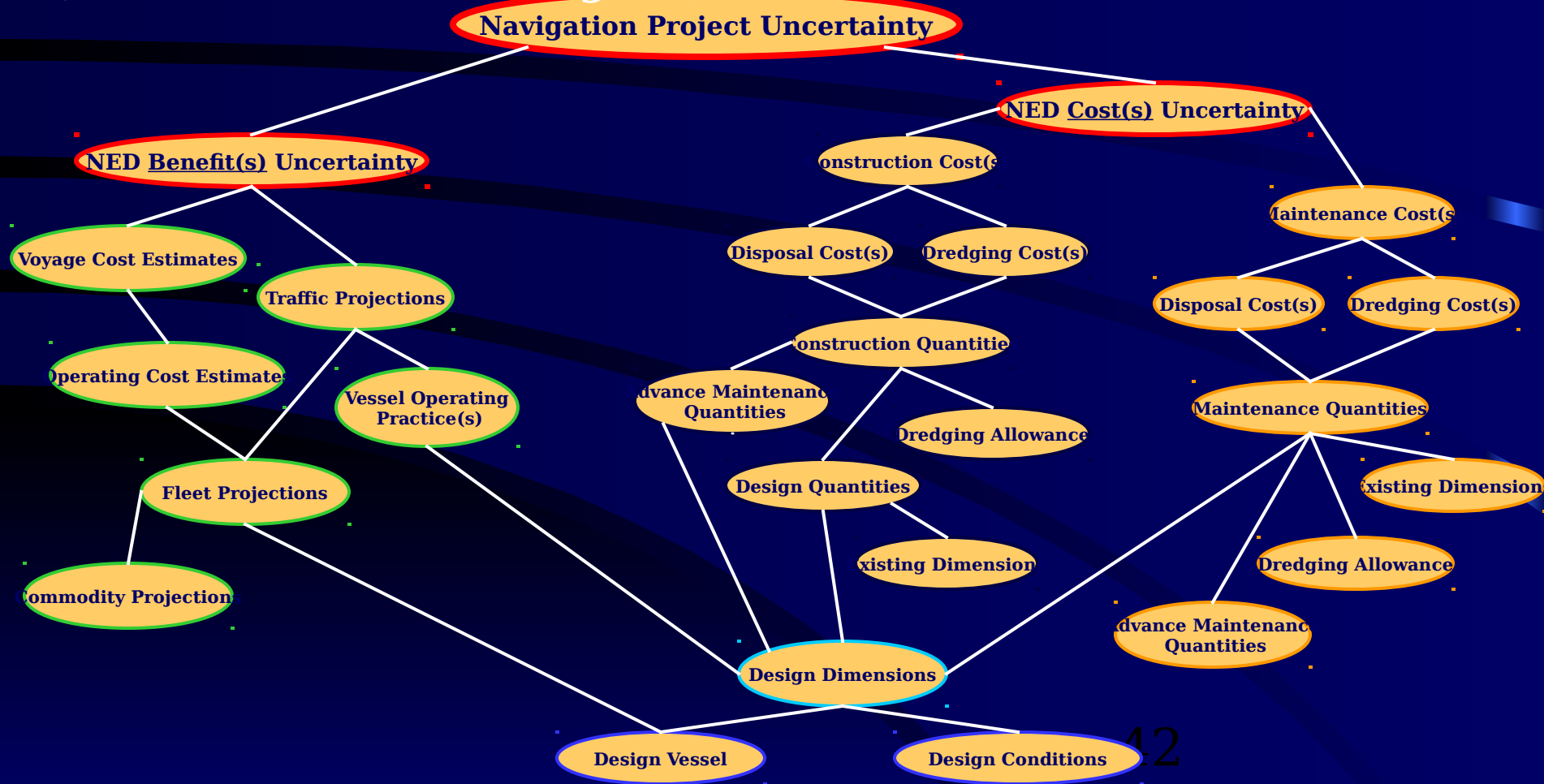
## Deep-Draft Navigation Risk(s) & Uncertainty (R&U) ("Flow" Diagram)

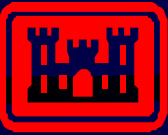




# Deep-Draft Waterborne Navigation - An Overview

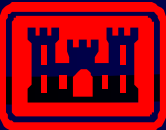
## Deep-Draft Navigation Risk(s) & Uncertainty (R&U) ("Hierarchal-Order" Diagram)





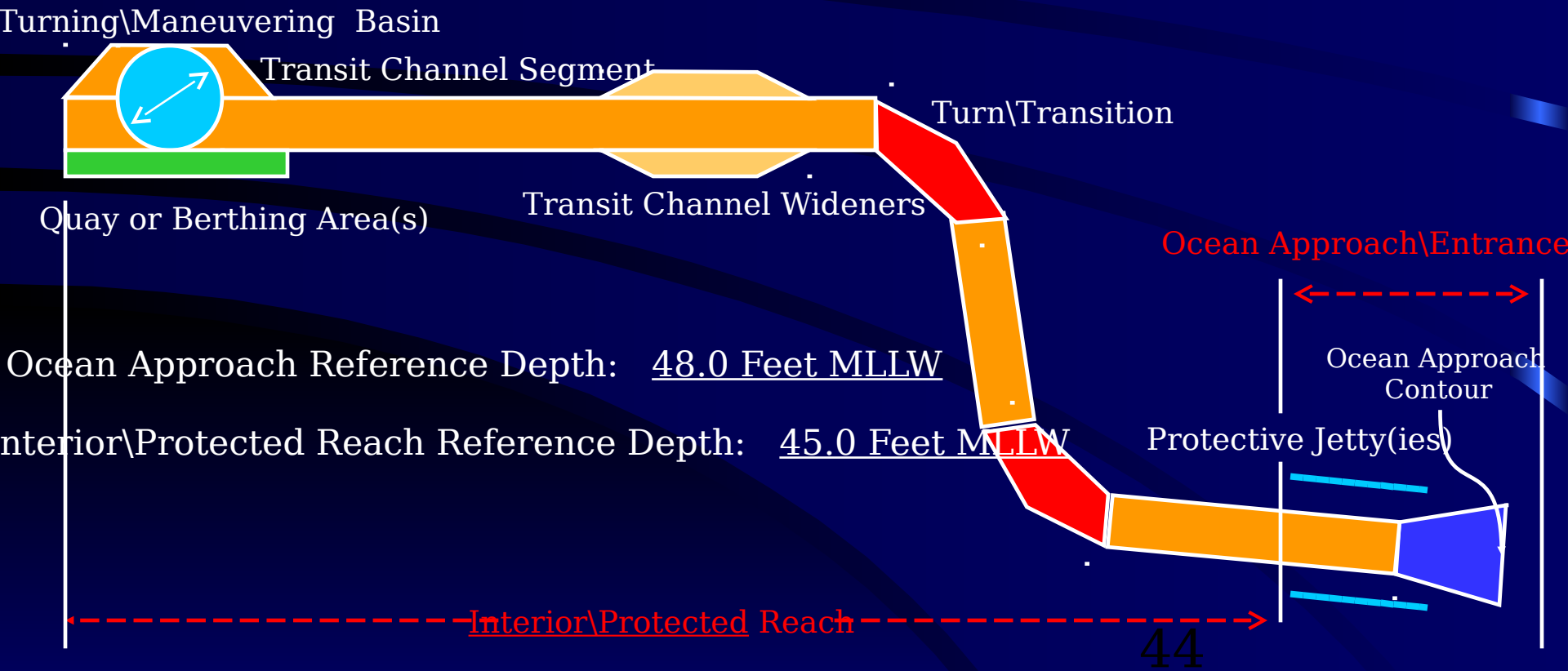
# *Deep-Draft Waterborne Navigation - An Overview*

- General Schematics for Waterway Terminology or Nomenclature
  - Conceptual Coastal Waterway\Entrance Layout
    - (Overhead\Horizontal Plane Perspective)
  - Waterway\Channel Cross Section(s)
    - (Vertical Plane Perspective; Typical Interior\Protected vs. Entrance\Ocean Approach Channel Segments)
  - Vessel Underkeel Clearances and Waterway Specifications
    - (Cross Section;Vertical Plane Perspective)



# Deep-Draft Waterborne Navigation - An Overview

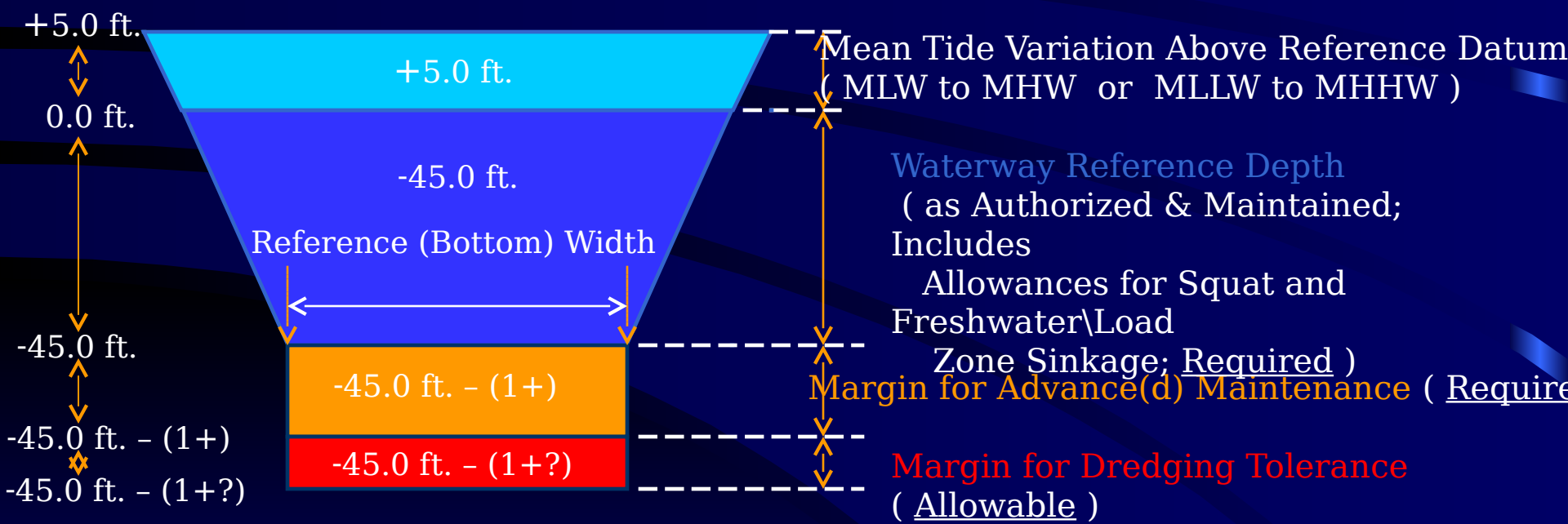
## Conceptual Waterway\Entrance Layout



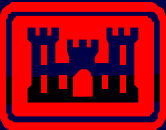


# Deep-Draft Waterborne Navigation - An Overview

General Channel Cross Section Schematic  
Protected Water Reaches\Interior Channels \*  
(Basic Increments for Depth Excavation)



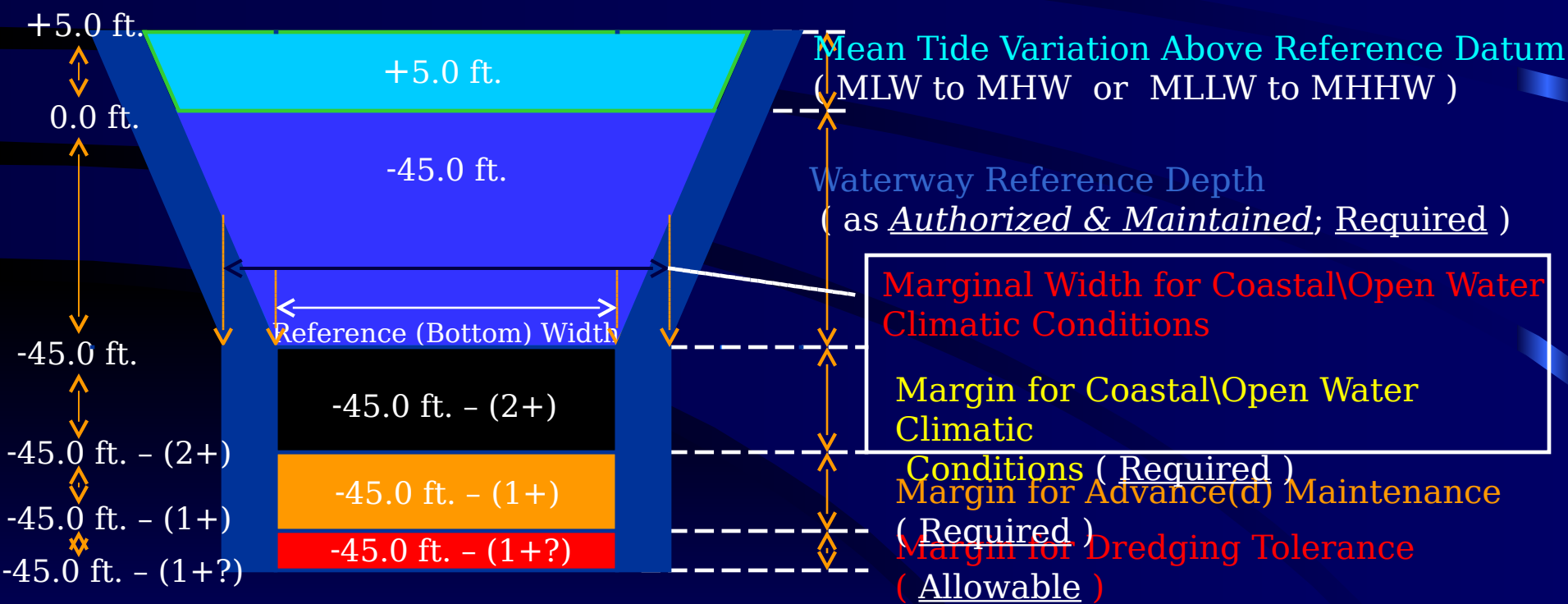
\* Vertical Plane Perspective of Waterway Cross Section



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# Deep-Draft Waterborne Navigation - An Overview

General Channel Cross Section Schematic  
Ocean Approaches\Entrance Channels \*  
(Basic Increments for Depth Excavation)



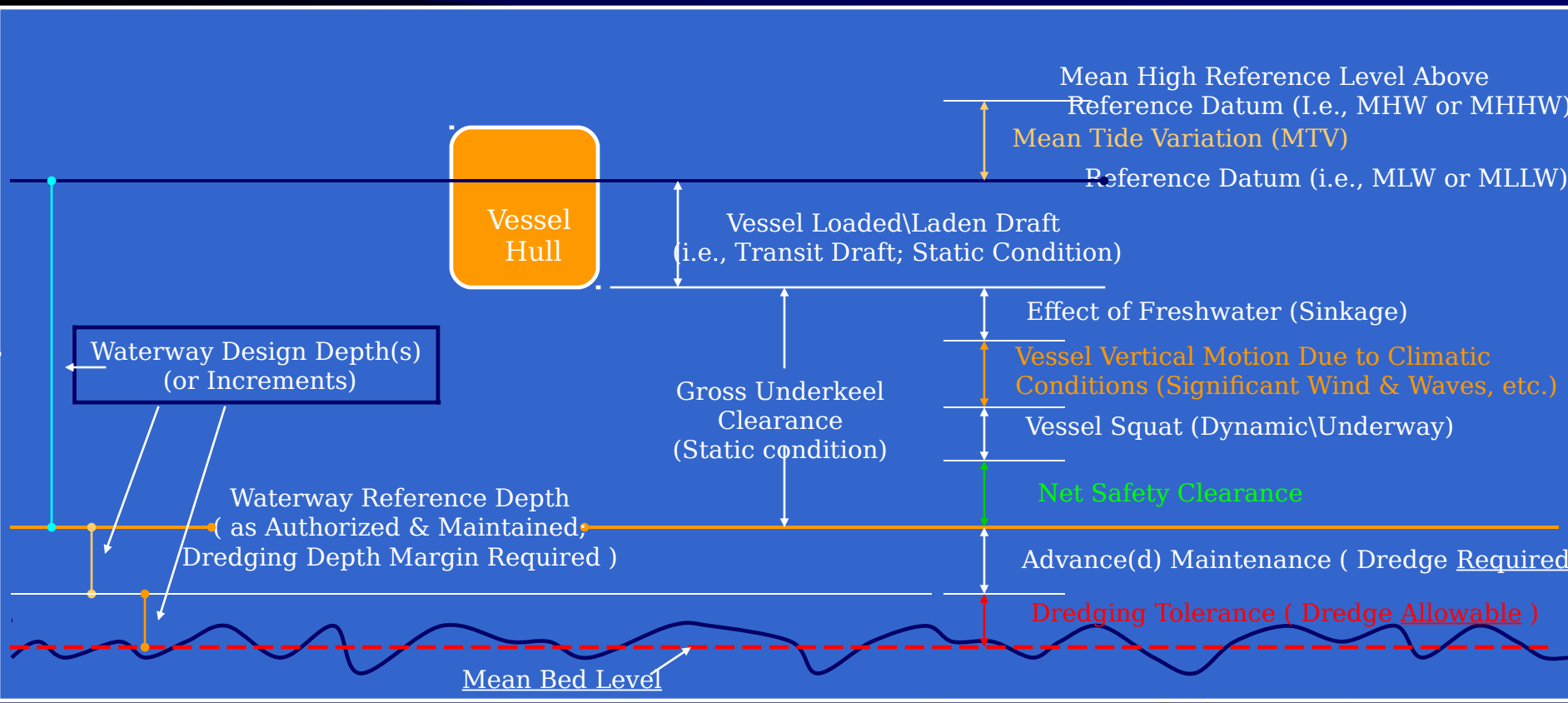
\* Vertical Plane Perspective of Waterway  
Cross Section

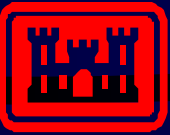


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# Deep-Draft Waterborne Navigation - An Overview

## Vessel Underkeel Clearance(s) and General Waterway Depth Specification

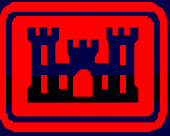




## *Deep-Draft Waterborne Navigation - An Overview*

- Supplemental Slides\Information for Reference\Individual Review
  - Information Concerning Research Efforts for Improvements to Waterborne Navigation Analysis & Planning



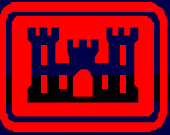


# *Deep-Draft Waterborne Navigation - An Overview*

- ***Activities for Integration of Engineering and Economic Analysis***

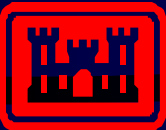
*[Undertaken with the Support of the U.S. Naval Academy USNA)]*

- *Design Procedure Literature Review*
- *Comparison of Study Procedures (& field surveys)*
- *Channel Design & Maintenance Assessment*
- *Safety Performance Review*
- *Shipping Trends Analysis*
- *Summary Report of Findings & Recommendations*



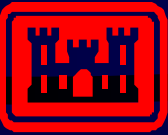
## *Deep-Draft Waterborne Navigation - An Overview*

- ***Ongoing Investigations\Evolving  
Methods or Guidance***
  - *Efforts to Enhance the Integration of  
Engineering & Economic Analysis  
for Planning of Waterway Design.*
  - *Efforts to Develop Practical/Applied  
Methods Analysis of Risk &  
Uncertainty (R&U) in Planning of  
Deep-Draft Navigation Projects.*



# *Deep-Draft Waterborne Navigation - An Overview*

- *Efforts to Develop Practical/Applied Framework for Analysis of Risk & Uncertainty (R&U) of Deep-Draft Navigation Projects*
  - *Literature Review and Survey of Methods*
  - *Delineation of Parameters Considered Most Significant*
  - *Development of Risk-Based Computerized Models for Standardized Practice*



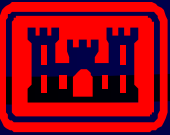
## *Deep-Draft Waterborne Navigation - An Overview*

- ***Navigation Data & Related Sources:***

- Cargo/Commodity Data*

- *Waterborne Commerce Statistics Center (WCSC)*
    - *Port(s) Authorities*
    - *Port Maritime Exchanges*
    - *Industry*
      - *Journal of Commerce (Port Import/Export Reporting System or PIERS)*

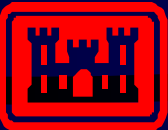
*(continued)*



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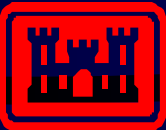
- Navigation Data & Related Sources



# *Deep-Draft Waterborne Navigation - An Overview*

- *Navigation Data & Related Sources*
  - *Traffic\Commerce Data*
    - *Cargo/Commodity Movements*
      - *Type and Volume of Movement(s)*
      - *Origin(s) and Destination(s)*
      - *Handling Requirements*
      - *Other*

*(continued)*



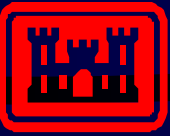
# *Deep-Draft Waterborne Navigation - An Overview*

## *• Navigation Data & Related Sources*

### *- Traffic\Commerce Data (continued)*

#### *• Vessel/Fleet*

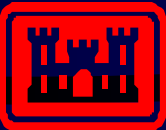
- Service Frequency by Type and Class of Carrier*
- Type and Tonnage of Cargo Handled*
- Physical Characteristics and Operating Cost(s)*
- Other*
  - » Port/Landside Facility Operations*
  - » Independent and Industry Forecasts*
  - » Other*



# *Deep-Draft Waterborne Navigation - An Overview*

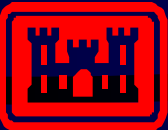
- ***Navigation Data & Related Sources:*** *(continued)*
  - *Vessel/Fleet Data*
  - *Waterborne Commerce Statistics Center (WCSC)*
  - *Lloyd's Register of Ships (LR)*
  - *Lloyd's Voyage Records*
  - *Clarkson Ship Register/Research Studies*
  - *Janes Maritime References* *(continued)*





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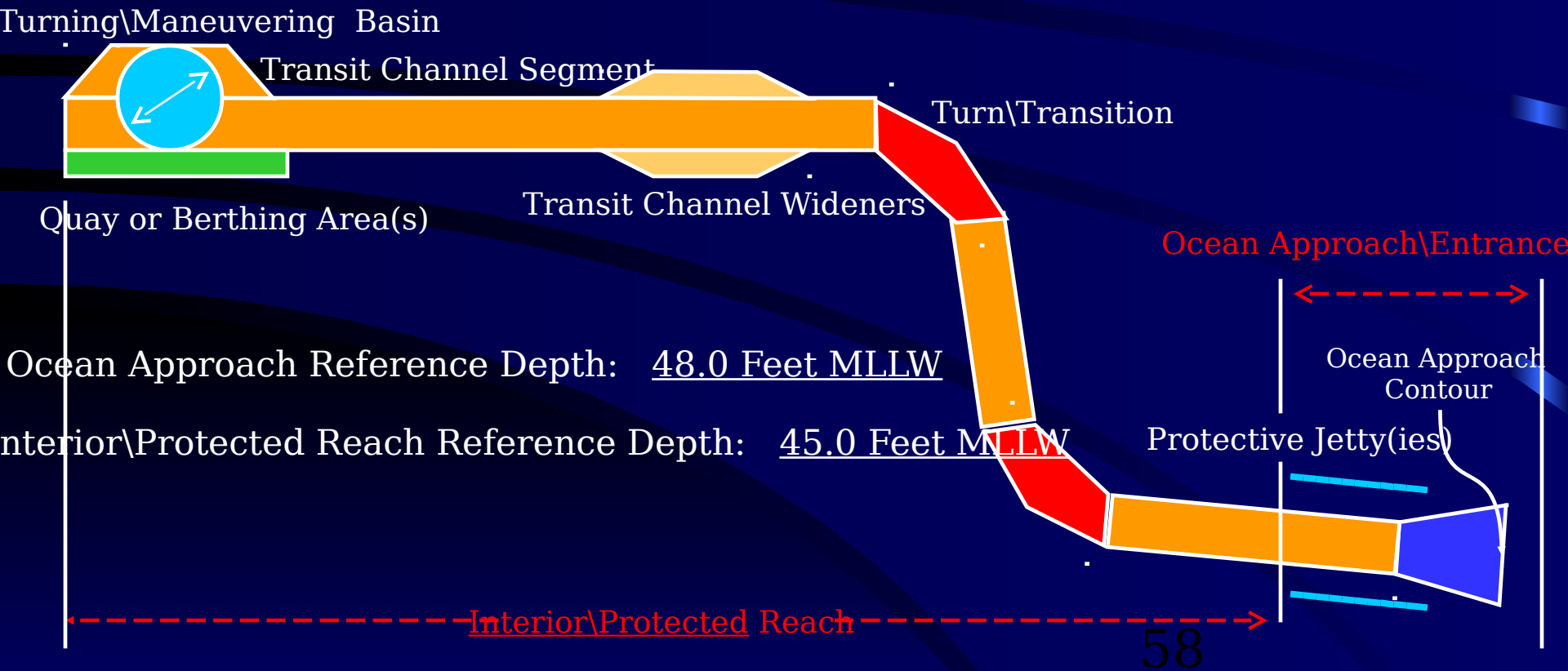
- ***Navigation Data & Related Sources:*** *(continued)*
  - *Fairplay Ship Register*
  - *Journal of Commerce (JOC) - Port Import/Export Reporting Service (PIERS)*
  - *Pilot's Log(s)*
  - *Shipping/Steamship Agents*
  - *Vessel Operators/Owners*
  - *Other*

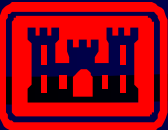


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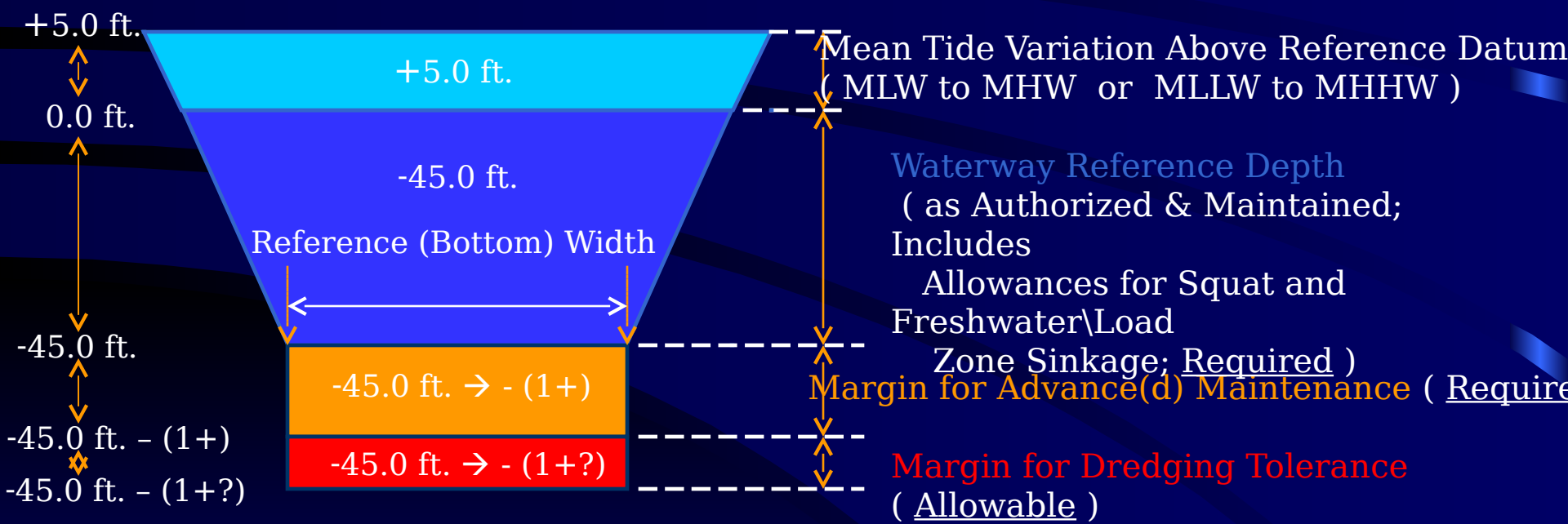
## Conceptual Waterway Layout





# Deep-Draft Waterborne Navigation - An Overview

General Channel Cross Section Schematic  
Protected Water Reaches\Interior Channels \*  
(Basic Increments for Depth Excavation)



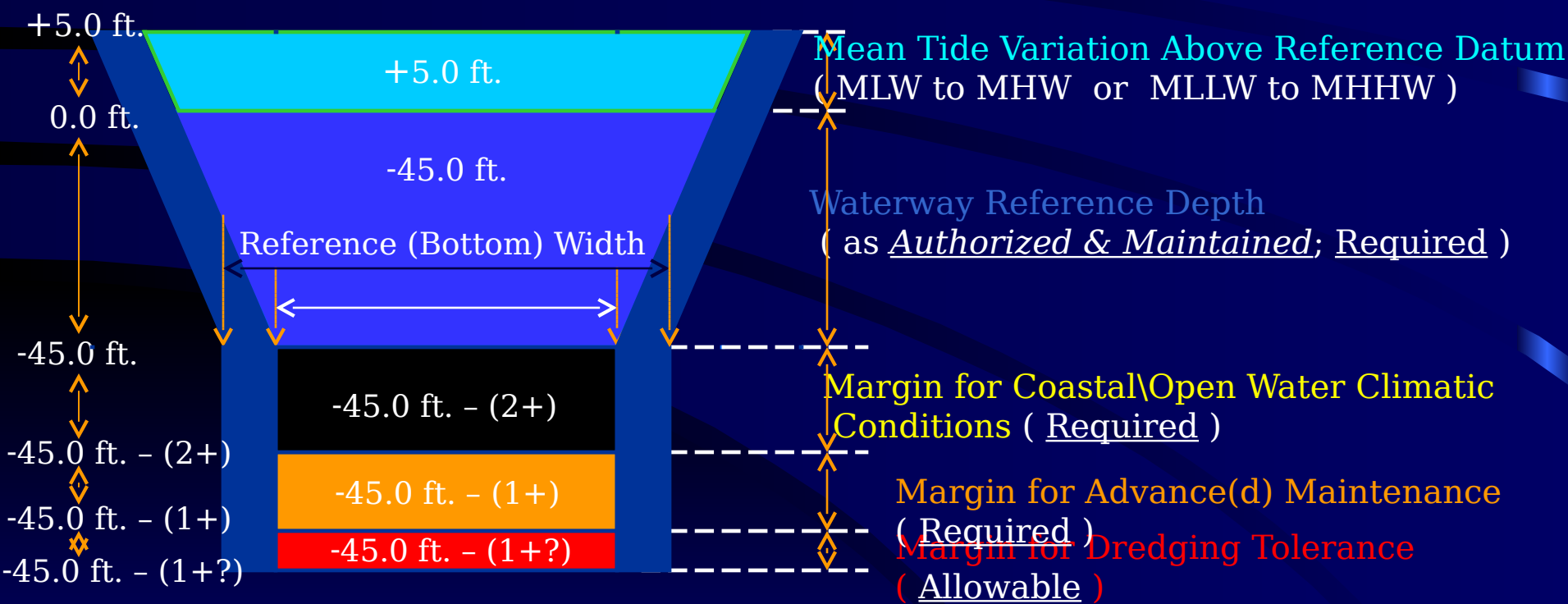
\* Vertical Plane Perspective of Waterway Cross Section



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# Deep-Draft Waterborne Navigation - An Overview

General Channel Cross Section Schematic  
Ocean Approaches\Entrance Channels \*  
(Basic Increments for Depth Excavation)



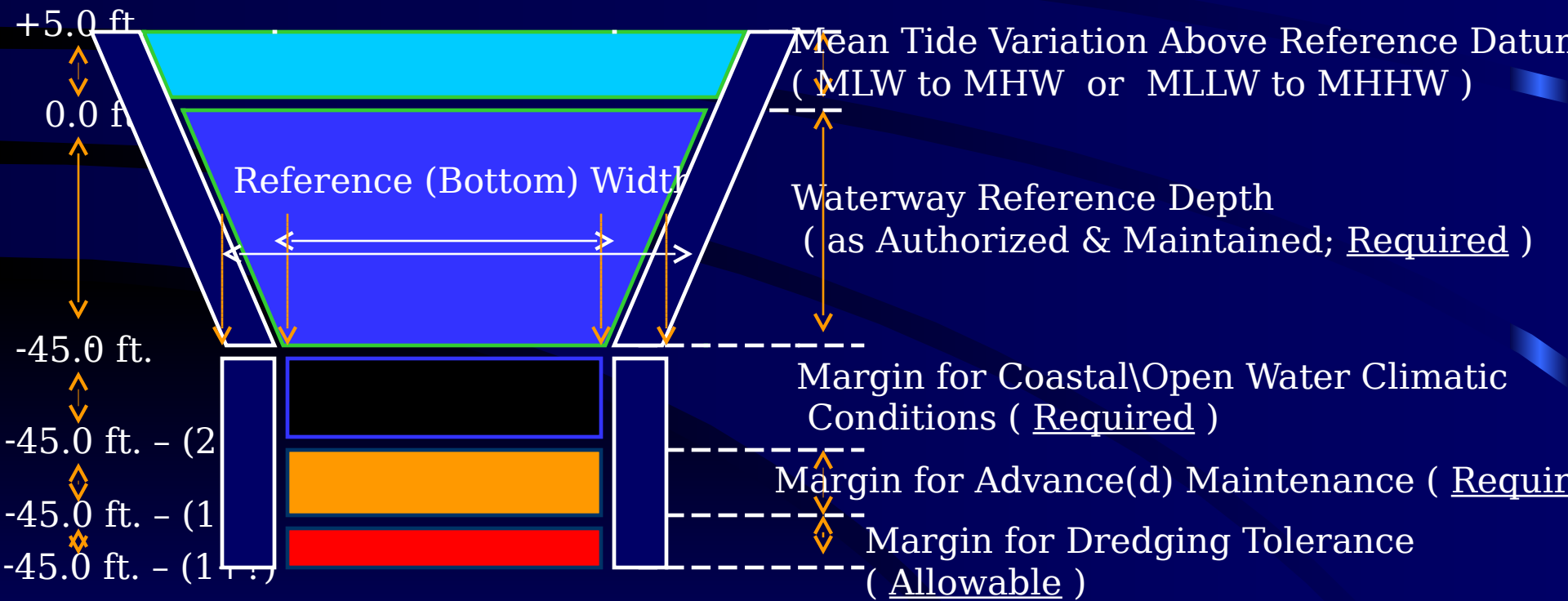
\* Vertical Plane Perspective of Waterway  
Cross Section

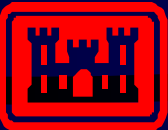


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# Deep-Draft Waterborne Navigation - An Overview

General Channel Cross Section Schematic  
Ocean Approaches\Entrance Channels \*  
(Basic Increments for Depth Excavation)\* Vertical Plane Perspective





# Deep-Draft Waterborne Navigation - An Overview

## Vessel Underkeel Clearance(s) and General Waterway Depth Specification

